

**International Harmonised Research Activities  
Vehicle Compatibility and Frontal Impact Working Group**

Minutes of the Seventeenth Meeting, held at TRL, on 5-6 December 2002

**Present:**

P O'Reilly	Chairman	T Hollowell	USA
A Hobbs	Secretary	E Faerber	Europe
K Seyer	Australia	A Lie	Europe
C Newland	Australia	D Dalmotas	Canada
P Prasad	US Industry	R Zobel	European Industry
S Southgate	US Industry	S Takizawa	Honda
S Gillingham	UK DfT	M Edwards	TRL (Part only)

**Apologies for Absence**

Apologies for absence were received from Mr Castaing, Mr Mizuno and Mr Tateishi.

**Minutes of the Sixteenth Meeting**

The minutes of the 16<sup>th</sup> meeting were agreed with the following amendments:

Minutes of the Fifteenth Meeting - USA position: Amended to read: NHTSA has determined that there may be minimum benefits from adopting the European ODB test as is due to the fact that automakers already are improving their vehicles in response to the IIHS offset testing (using the European procedure). However, NHTSA feels that the benefits would be greatly enhanced if the advanced lower extremities are utilized for both the 50th and 5th percentile adult dummies. As Mr Tateishi was not present, any comments he may have regarding the coverage of his presentations can be received at a subsequent meeting.

**Actions from the Previous Minutes**

Dr Zobel had expected that the document covering the comparison of 50 mm square and 125 mm square load cell elements had been supplied to the secretary. He will ensure that it is sent to the secretary for distribution, as soon as possible.

**Action Zobel**

Mr Southgate reported that he had not yet supplied members with definitions of Ford's car size categories. He will try to do this soon.

**Action Southgate**

**Industry Representation**

For US industry, Dr Prasad will be the representative. For Europe it will be Dr Zobel. For Japan, Mr Takizawa and Mr Kato will share the task. It was agreed that the minutes will continue to be sent to Mr Fay and Dr Nusholtz. The chairman stated that Mr Fay and Dr Nusholtz would still be welcome at meetings, should they wish to attend.

## **Data Reviews**

### ***Fleet Data***

Dr Hollowell distributed a document (Doc 129), and made a presentation (Doc 130), summarising the accumulated Fleet data. He explained that the information for each market cannot be categorised using the same definitions. It also became clear that some care is necessary in looking at vehicle mass as its definition might vary. It could be kerb mass, with or without fuel and other fluids and with or without an allowance for occupants. The data provide for each region was discussed in order to clarify some issues. For the ESV paper, it will be necessary to reduce the text length. However, this could be supplemented by a more complete text, which could be either used as an appendix or as a stand alone written paper. Dr Hollowell will liaise with Chairman on producing a shortened version suitable for the main body of the ESV paper.

### ***Geometrical Data***

A document (Doc 131) and presentation (Doc 132), which had been supplied by Mr Mizuno were discussed, although he was not present. Dr Mizuno had produced a wide ranging overview. The group recognised that he had rightly pointed out that there were differences in the way the data was collected. Because of this and the lack of clear definitions, there was some concern about the comparisons of the data for the different fleets. It is clear that the validity of Mr Mizuno's analysis is dependent upon the quality of the information supplied to him. Particular concerns were raised about the consistency of the longitudinal height data and the relative heights of cross members on SUVs and longitudinals on cars. Some members thought that the data on cross members might refer to weak non-structural members or ones situated far back from the vehicle's front. Information on the fore / aft position of such cross members would be useful. In addition to the average for each data set, it would be also useful to have information on the range of data for that parameter. This might overcome some concerns about the possible ways in which the data could mislead. It was also recognised that the use of data based on the models chosen in each region could also be misleading, as their choice was not necessarily based on sales volume.

### ***Accident Data***

Mr Dalmotas presented his review of the accident data. For the US, the fatality data clearly showed how the majority of fatalities had moved, over recent years, from car to car impacts to LTV to car impacts. He then explained that the analysis looked further into fatality rates for impacts between cars of different sizes. He went on to explain that the Canadian analysis was virtually complete and he expected to finish the all the analysis before Christmas.

### ***Crash Test Data***

Mr Faerber explained that his analysis would be based on documents presented to the IHRA group since the last ESV conference (Doc 133). The secretary will send any original versions of documents that he has for Mr Faerber to extract from for his report.

### ***Fleet Modelling***

Although fleet modelling had not been identified as a subject for anyone to provide a draft for, Dr Hollowell agreed to supply such a draft for the paper.

### **ESV Paper**

The chairman explained that he and the secretary had drafted an initial outline for the ESV paper. This could be used as a basis for discussion in the meeting. This draft was discussed at length and its content were developed. A copy of the draft will be distributed with the minutes. For the next meeting, Dr Prasad will produce an analysis of the effect of mass ratio. Dr Hollowell will also aim to present additional information on this subject.

It was agreed that it might be desirable to include some of the tables which the group was developing. The table detailing the characteristics required to improve compatibility might be particularly useful along with the one covering the accidents to address. It was not thought that the table covering the timescale to test procedures was appropriate.

### **Current Status and Update Reports**

#### ***EEVC***

Dr Edwards gave a presentation on the development of the full width deformable test and the analysis technique (Doc 134). He explained how the data was analysed, with the option to weight vertical and horizontal homogeneity differently, if desired. He then went on to show that the procedure was able to distinguish between cars showing poor structural interaction and modified cars, which were seen exhibited better interaction in crash tests.

Dr Zobel made a presentation of the results of simulation detailing the proportion of energy absorbed by different parts of the car's frontal structure (Doc 135). He went on to show some comparative heights of longitudinals. He proposed that the TRL rating system could be adapted to encourage forces towards the current level of US and EU bumper height requirements. Following this he suggested a method of setting frontal forces based on meeting compatibility requirements for mass ratios of up to 1.6. Finally, he presented data showing the difference in deformation of a PDB caused by removing the barrier from the front of the car, to which it had become impaled.

Dr Prasad expressed concern about expecting restraint systems to cope with a pulse equating in severity to a square wave pulse of 30g. This may be achievable for front seats with sophisticated systems but may not be feasible for rear seats, with less sophisticated restraint systems. He thought that 20g square wave, which could equate to a 30g peak of some milliseconds exceedence, would be a better target value. He also favoured choosing an average mass car and trying to make heavier and lighter cars compatible with the average mass car. In response, Dr Hollowell referred the group to Document 36, which gave deceleration data recorded in FMVSS 208 and US NCAP tests, where survivable dummy injury parameters were recorded.

#### ***Japan***

Mr Takizawa gave a presentation on Honda tests using the Full width deformable barrier and the PDB (Doc 136). With the Honda Legend there is a subframe set well back from the front (480 mm). The load detected from this, by the load cell wall, was limited. Although the analysis had intended to be the same as that used by TRL, there were some questions about this. Mr Takizawa

will try to supply the data to Mr Edwards at TRL and he will try to run it through the TRL analysis and compare the results given by Mr Takizawa. A further series of tests are going to be carried out on a Mitsubishi Grandis. On this car, the subframe is only 260 mm from the front.

## **USA**

Dr Prasad presented accident data related to injuries in lower speed impacts (Doc 137). He repeated the earlier assertion made by Mr Southgate that intrusion was not the cause of these injuries. He had now repeated the analysis using CCIS data. Mr Hobbs was still concerned with the assumption that the injuries were caused by deceleration. Mr Southgate will supply the case numbers for the CCIS cases to Mr Hobbs so that they re-examine them.

### **Action Southgate and Hobbs**

Dr Hollowell described the proposed test programme using the Navigator and the plans for tests with different sizes of load cell element, with and without the deformable face (Doc 138). He went on to present further details of the US modelling programme (Doc 139).

## **Tables Update**

In discussion, the tables were amended to take account of an EEVC review of their entries in the first table. The last table was also amended for frontal force and deceleration pulse for the two MDB tests.

### ***Accidents to Address in Considering Compatibility***

	Essential	Very Desirable	Desirable	Not Important
Mini - Super Mini	E, J		A	C, US
Car	A, E, C, J, US			
Car >2,500 kg (GVW)	C, US		A, E, J	
Sports car	C, US	E	A, J	
MPV	C, J, US	A, E		
Small SUV	A, C, US	E, J		
Large SUV >2,500 kg (GVW)	C, US	A	E, J	
LGV	C, US	A, J	E	
HGV (Car actions)			E	
Roadside Obstacles (ditto)	A, C	J, US	E	
<b>Influence on others</b>				
Side Impact	A, C, J, US		E	
Pedestrians	J	A	E, C, US	

***Characteristics Required to Improve Compatibility***

	Essential	Very Desirable	Desirable	Not Important	Not Considered
Interaction - Height	A, C, E, J, US				
Interaction - Area	A, E, J	US	C		
Frontal Force	A, E, J, US	C			
Compt Strength (stability)	A, E, J	C, US			
Deceleration Pulse		A, E, J, US	C		
Mass					A, C, E, J, US

***Time Scale to Test Proposal***

	Near Term (2005)	Medium Term (2010)	Long Term (2015)	Never
Interaction - Height	A, C, E, J, US			
Interaction - Area	A, C, E, J, US			
Frontal Force	A, C, E, J, US			
Compartment Strength	A, C, E, J	US		
Deceleration Pulse	A, C, E, J, US			
Mass				A, C, E, J, US

### *Characteristics in Candidate Test Procedures*

	Full Width Rigid +LCW	Full Width Deform. + LCW	ODB @ 64 km/h + LCW	ODB @ 80 km/h + LCW	PDB + LCW @ 60 km/h	PDB Constant Energy + LCW @ 48 km/h min	Offset MDB + LCW @ 56 km/h
Interaction - Height	Yes <sup>1, 2</sup>	Yes <sup>1</sup>	Yes <sup>3,9</sup>	Yes <sup>3,9</sup>	Yes <sup>4</sup>	Yes <sup>4</sup>	? <sup>5</sup>
Interaction - Area	? <sup>2</sup>	Yes	No	No	Yes <sup>4,10</sup>	Yes <sup>4,10</sup>	Yes <sup>5</sup>
Generates Longitudinal Shear in F/A Vertical Plane	No	Yes <sup>1</sup>	Some	Some	Yes	Yes	?
Generates Longitudinal Shear in F/A Lateral Plane	No	Some	Yes	Yes	Yes	Yes	Yes
Frontal Force	Yes <sup>1, 3, 6</sup>	Yes <sup>1</sup>	Yes <sup>3</sup>	No <sup>11</sup>	Yes <sup>7</sup>	Yes <sup>12</sup>	Yes <sup>14</sup>
Compartment Strength	No	No	No <sup>13</sup>	Yes	No	Some <sup>8</sup>	Some <sup>8</sup>
Deceleration Pulse	High	High	Low	N/A	Low	High <sup>8</sup>	Mid
Vehicle range							
Objective criteria							
Loading as car to car							
Extent of crush depth							
Load Cell Wall used							

<sup>1</sup> For limited deformation

<sup>2</sup> May be influenced by local projections

<sup>3</sup> May be influenced by engine bottoming out

<sup>4</sup> May be influenced by variation in honeycomb stiffness / only final value

<sup>5</sup> Depends on barrier face and influence of pitch

<sup>6</sup> May be influenced too much by inertial forces from structure

<sup>7</sup> May be limited by honeycomb strength

<sup>8</sup> Low mass cars

<sup>9</sup> May be influenced by load spreading

<sup>10</sup> Concern over effect with stiff cross beams on rotation

<sup>11</sup> May be calculated from Force / deflection trace

<sup>12</sup> Up to test severity, Also requires self protection

<sup>13</sup> Unless compatibility protection speed is reduced

<sup>14</sup> Unless inertial effects of accelerating honeycomb are not negligible and cannot be accounted for

## **Aspects Requiring Further Consideration**

The group discussed the need for consideration to be given to other aspects. These were listed as:

### *Structural Interaction*

Area of interaction Fixed or car defined?

Width of interaction (relation to longitudinal separation)

Height of interaction (Average height of force - cf bumper height requirements, influence of approach angle)

Height overlap (range to cover Sports v SUV or sliding scale)

Homogeneity Measure (Overall, or row and column weighting)

### *Frontal Stiffness*

Frontal force and acceptable deceleration level (implications over full range of accident severities)

Mass Ratio to cover (1.6 or relate to average car mass, Coverage range - appropriate for Europe and US?)

### *Passenger Compartment Strength*

Increase of frontal Stiffness

Compartment stability requirement ?

### *Additional Points*

Benefits

Identifying good and bad performers

Confidence that car design would go in correct direction (can a dangerous design be conceived of which would meet the test)

## **Initial Test Procedure**

In the interests of harmonisation, the US requested that the EEVC be asked to consider the full width rigid/deformable test, with load cells, as a first step, towards compatibility. The other test procedures under development could be considered for later stages. This was supported by Australia and Canada, with an interest being expressed by Japan. A minimum requirement could be, for example, the average height of force. Unfortunately, this proposal was made near the end of the meeting and the EEVC representatives had left to catch their flights. Their attention is drawn to the request that it consider such a first step.

**Action Faerber and Lie**

## **Date and Location of Next Meetings**

The next meeting is planned for 23 - 24 January 2003, at TNO in Delft. This meeting will follow EC "VC Compat" Kick off and Industrial Liaison meetings, also being held at TNO on 21 - 22 January 2003. (Secretaries Note: At the time the minutes were distributed, there was some doubt about the dates for the VC Compat meetings. If they are delayed, the location of the IHRA meeting may be moved.

A further meeting is still being planned for Japan, at the beginning of the week following the ESV Conference. The meeting will include a one day joint meeting with the IHRA Side Impact group and a further day may be required to see the Japanese crashed cars.

C A Hobbs  
18 December 2002